has its seat in the lateral column, Hammond describes the walk as being associated with a lateral swing of the body, and the patient glides always in a serpentine manner, the extensor muscles not having power to lift the feet from the ground.

The inco-ordination of muscular movement in alcoholism is always associated with delusions. There is also a species of loss of co-ordination which occurs with the early stages of general paralysis; the acts of sewing or writing are impossible.

Loss of co-ordination may be found by several tests to which the patient may be subjected, but as every one is familiar with these, I will only allude to them in a general way. One which Wunderlich and Romberg considered conclusive is the inability to stand with the eyes shut. The patient brings his heels together, and shuts his eyes, when he will immediately topple over and fall. This may be detected when sclerosis of the posterior column of the cord exists to a very slight degree, by a swaying to and fro of the body.

The location of places is lost when there is sclerosis, and it will be impossible when the senses do not guide the patient for him to exactly find any small spot with the tip of his finger when his eyes are closed; for instance the tip of his nose.

If his legs are changed very rapidly from one place to another, he will find it almost impossible to locate their final position when they are at rest. When the mind is detracted from the body, as occurs when the patient is reading, he will, when unexpectedly asked, be unable to tell where his feet are. For instance a patient now under my charge, when lying on the sofa reading with his feet higher than his head, will begin to make some change supposing them to be upon the floor or on a level with his body.

These symptoms occurring with others will always enable us to approximately arrive at a diagnosis. Sclerosis, whether diffused or spinal, is symptomatized notably by marked inco-ordination and trembling. Paralysis agitans comes next, and we may direct our attention to these primarily in nearly every case.

ART. IV.—*Historical and Analogical Record of the Siamese Twins.*

By ROBERT P. HARRIS, M.D., of Philadelphia. (With a wood-cut.)

Nativity, etc.—Eng and Chang were of Siamo-Chinese blood, as are many of the three millions of inhabitants of Siam. Their father was born in China, and spoke the Tai-cheu dialect, went into Siam, and married a native woman whose father was Chinese, and mother Siamese, thus causing the twins to be three-quarters Chinese blood, and accounting for their dark colour and Chinese appearance; the pure Siamese being a bright gamboge-yellow like colour. They were born at Mà Klaung (*Meklong*), a small fishing village, some sixty miles southwest of Bangkok, the capital. Their parents were well built, of medium Chinese height, and belonged to the poor class of *boat inhabitants*, living in small floating houses, moored along the banks of rivers; of whom there are great numbers in Siam. The mother of the so-called *Siamese* twins was about 35 years old at the time of their birth, and of a complexion resembling that of the Chinese rather than Siamese. She is said to have brought forth four female children prior to the "twins," and to have had a family of fourteen in all; ten of them being twin births. No special inconvenience was experienced during her period of gestation, and she declared upon several occasions that Eng and Chang were delivered reversed, the feet of one, and head of the other being together, and that there was no marked difficulty in their extrusion, as they were quite small. In corroboration of this statement of the presentation of the twins, it has been repeatedly affirmed by them that in early boyhood, and up to the age of ten or twelve years, they very frequently assumed a reverse position, with the head of one towards the legs of the other, when at play upon the floor or ground.

It will be noticed that we have reversed the usual order of the names of the twins, going back to that adopted in Europe many years ago, when Eng was given the precedence, as the larger of the two, and standing upon the right. We see no reason why Chang, simply upon alphabetical principles, should be most prominently named, when, by so doing, it only leads to error and confusion in describing them in a distinctive sense, as to physical condition, peculiarities, etc. We have, therefore, resumed the order under which there can be no possibility of mistake. *Eng* (meaning *right*), being the larger, taller, stronger, more healthy, least deformed, and placed upon the right, is named first, as we conceive for these reasons he very naturally should be. In the *Ritta-Christina*, Ritta was on the right, and for this reason was named first.

Eng and Chang were quite feeble at birth, and for the first six months of their infancy. Chang was then the larger and became the more healthy boy of the two, Eng being rather delicate for some years; after which he in turn grew to be the more robust, and so continued throughout life. The exact date of their birth cannot be ascertained, although when exhibited in Philadelphia from Oct. 6 to 10, 1829, their exhibitor gave it as May, 1811. Their parents in after years, when questioned by one who spoke their language, were not so definite, and said that it was either in the latter part of 1811, or beginning of 1812. They were, therefore, as near as can be ascertained, about 62 years old at the time of their death (Jan. 17, 1874), an age very far in advance of any other diploteratological specimen upon record. It has also been stated that at the time of their birth it was with some difficulty that their lives were saved from destruction by order of the king, who held a very prevalent superstition, that such freaks of nature were portentous of evil to the reigning power, numerous evidences of which may be found in the histories of monsters.

Discovery and Removal from Siam.—Their existence was first revealed to the civilized world by Mr. Robert Hunter, a British merchant residing at Bangkok, who met with them when boys of twelve or thirteen years of age, in the year 1824, as they were boating, stripped to the waist, on the river Menam, not far from the capital, where their parents then resided; being attracted toward them by their strange appearance in the distance at night. He made various unsuccessful attempts to gain permission to take them to England; and finally prevailed upon their parents and King Chowpahyai to let them go. They set sail on April 1, 1829, in the ship Sachem, Captain Coffin, via Boston, which port they reached in August. Here they were carefully examined by the late Prof. John C. Warren, M.D., of Harvard College, the first physician to make an exploration of their bond of union, and an investigation into their special mental and physical relations with each other. The results of his observations were sent in letters to several prominent editors of medical journals in this country[1] and in England. At that time, Eng was about 5 ft. 2 inches high,[2] and Chang half an inch shorter. They were believed to be eighteen years old; wore very long, black queues, wound thrice around the tops of their heads coil within coil; and presented the characteristic features of the Chinese race, being, as before stated, but quarter-blood Siamese.

Migrations, etc.—Having remained eight weeks in the United States, divided between Boston, New York, and Philadelphia, they set sail directly for England from New York, October 16, and reached London on the 20th of November, 1829. After a tour of exhibition, and being disappointed with the cold damp climate of England, they returned in a few years to this country, which from that time became the home of their adoption; and finally assuming the family name of Bunker, settled upon farms in North Carolina, where they resided at the time of their death.

Not being permitted to visit France, upon their first European trip, although much effort was made in Paris to get them admitted, especially on the part of Coste, the embryologist, they made a second attempt in 1835, which proving successful, we find due notice of their appearance and peculiarities, in several of the Parisian medical periodicals of 1835-'36. We presume the cause of opposition to their being exhibited, was that which prevailed against the *Ritta-Christina*, in Paris, in 1829, viz., a popular impression that a sight of them might cause some of the French women to breed abnormal children of a similar type; an opinion that is by no means confined to France, nor excluded by the medical profession, as the reports of cases of monsters in medical journals will from time to time evince.

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[1] See Am. Journ. Med. Sci. for Nov. 1829, p. 253, where will also be found an excellent representation of the twins.

[2] Eng finally reached a height of 5 ft. 5 in., and was $1\frac{7}{8}$ in. taller than Chang. This difference was almost entirely between the band and the tops of their heads. Chang, if straight, would have been about 5 ft. 4 in. He became more crooked after his attack of paralysis, in 1869.

After an interval of 33 years, the twins, in 1869, made a third trip to Europe, which was much heralded at the time, and becomes now a matter of historical interest, because it was stated that they went mainly with a view to consult leading Surgeons of Great Britain and France, as to the propriety and feasibility of an operation for separation. It is true that with this apparent intent they did present themselves as proposed; and that they were examined by Sir Henry Thompson, Sir William Fergusson, Prof. Syme, Sir James Y. Simpson, Prof. Nélaton, and others: but the real cause of this journey was to retrieve their lost fortunes, using these examinations as a scheme whereby to secure a free notice by the press and a larger attendance on the part of the curious at their exhibitions, a *ruse* often practised by them in former years under direction of their agent.

We will find by reference to the leading medical journals of 1829, '30, '31, '36, and 1869, the most elaborate articles that have appeared in reference to their peculiar manner of union, and the cases which most closely resembled it. It is questionable whether the Siamese Twins ever fully realized the inconveniences of their attachment, or *sincerely* desired to be separated. When the late distinguished Naval Surgeon, Thomas Harris, examined them at the Masonic Hall in Philadelphia, in 1829, and hinted at the propriety of an operation for separation, Chang, who from early childhood was never remarkable for his amiability, tried to kick him, as a mark of disapprobation of the proposal. It is true that many years later, under the feeling of antagonistic hatred engendered by a quarrel, they did desire their family physician to cut them apart; but whenever questioned in calm moments, declined the office of the Surgeon. How much may have been due to fear of suffering, or of a possibly fatal result, we cannot tell; but the excuses framed by them appear to have been largely based upon a want of appreciation of any happiness to be obtained by an independent existence, believing themselves to be quite as much in the enjoyment of it as those with whom they came daily in contact. A part of their objection may have also arisen from their notoriety as a curiosity giving them a certain living, in the event of being by any means reduced to poverty; and an antipathy to parting with their world-wide fame, from a species of pride, which, although unaccountable, nevertheless prevails to some degree with the congenitally deformed. Had they been successfully separated in adult life, at their own request, we should have seen all their individual physical defects very prominently brought to notice.

Individual Physical Defects.—From somewhat early life Eng was the larger, taller, and stronger of the two; but both were unsymmetrical in development. Chang was noticed as long ago as 1830, to have a very marked right lateral curvature of the spine, bending his chest over to the left; and this in later years was accompanied with an increased obliquity in the line of elevation of the shoulders, the left being much depressed below the right. In an independent state, he would have walked obliquely to the left, with his left foot turned outward and right inward, his head bent over to the left, and face directed to that side; and it is exceedingly doubtful whether he could ever have recovered from the effects of early necessity, and the abnormal development of his joints and muscles, so as to enable him to walk directly forward.

In a reverse direction, the same remarks will hold good as to the walking of Eng, who, although much more erect, would have had the same locomotive defects to contend with. The right arm of Eng, and left of Chang were better developed than their opposites, and the left shoulder of Eng, and right of Chang, much the wider, from the spine, to the end of the acromion process of the scapula.

The necessity of always looking obliquely forward, affected the sight of their outer eyes from quite an early period (noticed by St. Hilaire, in 1836); probably from childhood; and this became so marked late in life, that with these eyes alone, they could scarcely distinguish any object. Chang was rather deaf in both ears, but the hearing of the brothers was most defective in the opposing ones. The outer legs were stronger and better developed than the inner ones, as the latter had much less freedom in walking. All of these defects were the result of a relative position assumed in childhood, and maintained throughout life. This also had the effect of making the opposing side of their chests *absolutely* flat; which was compensated for by a greater degree of convexity than normal upon their free sides. It can readily be seen, that in a separated state each would have probably been under the necessity of learning to walk; and would have presented a singular gait and figure, as compared with normal subjects.

Theories of Union.—Considered in a teratological sense, Eng and Chang belonged to the genus Omphalopagus (ομφαλος, the navel, and παγω, I fasten); and to the variety, Ziphodidymus, (ξιφος, a sword, and διδιυμος, a twin); according to the classification of Dr. George J. Fisher, of Sing Sing, New York. There are many varieties of the omphalopagus genus, the most frequently to be met with of the homologous duplex twins reported in medical periodicals. They are rarely born alive, and when so, seldom survive more than a few hours or days. In these *ventre-à-ventre* unions, the connecting cartilages may be seated at the upper portion of a narrow isthmus, containing only the umbilical vessels, some interlacing fibres from the two diaphragms, and connective tissue; or the bond of union may involve the thoracic and abdominal cavities, so as to make them common to each, as low as the umbilicus, or it may be lower; within which will be found two or four lungs, two hearts or a double one, a single or double liver, connecting stomachs, one or two spleens, two or four kidneys, one or two sets of small intestines, the single one ending in a double caput coli, from which arise two large intestines, one for each fœtus, etc.

We may consider it fortunate that these extensive vital inter-communications are much the most common; and that those of a type to render an operation for separation, a subject for question, so rare that but one or two are reported in a century. During the last two hundred years but three cases are known to have been met with, of a class to render an operation at all possible, without a rapidly fatal termination; the whole of the remainder having such intimate connections, that the knife or ligature were not for a moment to be thought of. Even in the cases where no important vessels or viscera traverse the band, there is a considerable risk of a fatal result from inflammation of the incised or ligated parts, extending into the veins or peritoneum.

The cause of the formation of duplex twins must of necessity be largely hypothetical, and for this reason, very dissimilar views have been and are held by embryologists, as to the primitive condition of the ovum or ova producing them. The following are the theories in dispute.

1. That there are two distinct embryos, or germinal traces in one ovum, which become united in the course of development, and that these are parallel in the omphalopagi, and become one at the centre of contact.

2. That there is but one germ, which becomes double by a process of division.

3. That the ovum is abnormally compound from the beginning, and the organs and parts composing the double monster are at once produced from the germ, without either separation or coalition of parts, other than belong to the natural process of development.

Each one of these theories has had its strong advocates; but the first is that now generally held by teratologists, especially as regards homologous duplex twins. We are not of those who believe fully in the general application of this law to *all* forms of diploteratological cases, for some of them are much more readily explainable on the basis of an originally abnormal germ. If the *trace* which produces an inherited redundancy of parts, as where six well formed fingers and toes are obtained by the parental impress, may be rated abnormal to the extent of the redundancy, why may not a greater degree of the same condition in the ovum account for many of the varieties of monsters by redundance, as provided for in the third theory?

It is well known that a duplex germinal trace has been observed in a single-yolked goose egg; and that double-yolked hen eggs have been repeatedly experimented upon by incubation without producing duplex birds. It is a very satisfactory theory that the union of two parallel *traces* will produce such examples as the Siamese, Hungarian, Hindoo, and Carolina twins; that convergence of one or other extremity of the germs will by union account for many other forms; and that numerous sub-varieties result from irregularities of approach; but beyond and above all these are the cases which cannot be satisfactorily explained, without making an exception in favour of the theory of abnormally compound germs.

Dr. Fisher[1] says, "that the origin of *all* double monsters *is now known* to result from the development of two embryos, on the vitilline membrane of a single ovum, and *all their forms* to arise from the relative position and proximity or remoteness of the primitive germinal traces." To make this theory of universal application, we must account, in some instances, for the almost total disappearance of one twin germ, leaving but a distal fragment engrafted upon the otherwise normal body of the other, and in almost all instances attached to a corresponding structure. Such cases are more readily accounted for, upon the theory of an originally abnormal germ, than that of union by approach.

M. Coste,[2] the celebrated embryologist, examined the Siamese twins on the occasion of their first visit to France, in 1836, and in a note to the Académie des Sciences, expressed the opinion that they must have become united in the latter days of the first month, and when consequently they were not yet two lines in length. *He believed that their viscera were independent*, and that an operation of severance would probably have a favourable termination.

M. Le Sauvage,[3] of Caen, France, who claims to have been the first to elucidate the primary condition of the formation of double or diplogenous monsters, says: "I have demonstrated that no junction can be established except where two germs have been developed in a single ovule, and that then the two embryos must be contained in a common chorion; that they are constantly of the same sex; and that their coalescence is determined by the previous union of the two umbilical cords, the umbilicus always becoming, as it were, a point of departure for the adhesion." He calculates the time of the adherence of the Siamese brothers, as from the 15th to 20th day of intra-uterine life. From the tolerance of torsion in the band in early childhood, whilst the cartilages were soft, he formed an opinion that the connection was mainly areolar tissue; that as their development was normal, their umbilical vessels must have had a regular direction and growth to accomplish it: that "at the moment of union of the two embryos, the two intestinal masses in a rudimentary state were still contained in the membranes, and the regular direction of the umbilical vessels should lead us to think that they had been especially transmitted into each abdomen, which excludes all idea of communication between the intestines."

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[1] Trans. N. Y. State Med. Soc., 1868, page 279.

[2] Journ. Hebdomadaire, 1836, vol. i., page 55.

[3] Archives Générales de Medecine, 1837, vol. ii.; 2d Series, page 71.

Diagnostic Examinations of the Bond of Union.—In view of the post-mortem revelations, this portion of our historical record becomes of peculiar interest, as it is natural for us to desire to know how nearly correct were the physical explorations made during life, in determining the anatomy of the band.

Prof. John C. Warren,[1] previously quoted, says of it: The upper part is hard, and composed of the ensiform cartilages, which appear to meet at an angle, and to be connected by a ligament, so as to form a joint. The breadth of the cartilage is an inch and a half, and thickness about an eighth of an inch. This joint appears to open and shut according to the position of the twins. "There is no doubt a network of bloodvessels, lymphatics, and some minute nerves passing from one to the other" . . . . "Another question which has presented itself in relation to them, is whether it would be possible to separate them from each other with safety. There seems to me nothing in the connecting medium which would render such an operation necessarily fatal. *It is not impossible that the peritoneum is continuous from the abdomen of one to that of the other.* The division of this membrane would involve some danger, though not very considerable."

The late Prof. Valentine Mott, of New York, and Dr. Thomas Harris, U. S. N., of Philadelphia, examined the twins subsequently in their respective cities, and privately expressed a somewhat similar opinion.

Sir. Astley Cooper examined them in London, in 1830, a few months after Dr. Warren, but does not appear to have been at all searching in his investigation, as he said that the band was composed of the ensiform cartilages, skin, and areolar tissue. He evidently was not at all satisfied as to its true nature, for he was not willing to say that he would be ready to operate if called upon; escaping from the inquiry, by turning the matter of *attachment* into a pleasing joke.

George Buckley Bolton,[2] M.R.C.S., presented (April 1st, 1830) a very elaborate report to the Royal Society of London, in which he says: "Under the cartilages, while they stand in their ordinary posture, are *large hernial sacs opening into each abdomen*, and into which on coughing, congenital herniæ are forced; probably in each boy formed by a portion of the transverse arch of the colon; generally, however, and under ordinary circumstances these herniæ are not apparent. Whether there is a communication between the two abdominal cavities, or a distinct peritoneal sac belonging to each hernia, is by no means obvious." . . . . . "When these herniæ protrude, their respective contents are pushed forward *as far as the middle of the band.*" Mr. Bolton took several careful measurements of the band, with the twins standing face to face, as they are now represented in the cast, in the Mütter Museum of the College of Physicians, of Philadelphia, and gave its dimensions as follows: length at top $1\frac{3}{4}$ inches, at bottom not quite 3 inches, vertical depth $3\frac{1}{4}$ inches, and thickness $1\frac{5}{8}$ inches.

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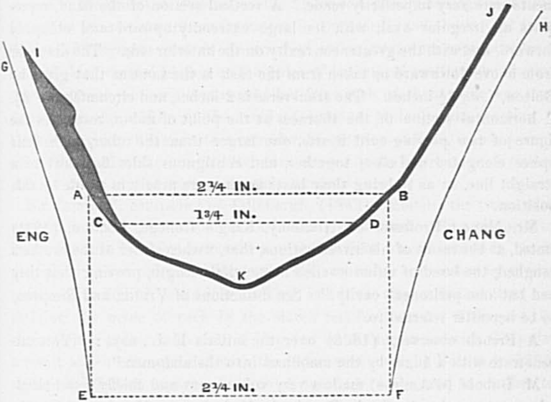
[1] Amer. Journ. Med. Sciences, Nov. 1829, page 253.

[2] Philos. Trans. 1830, page 177.



Very great discrepancies exist in the measurements taken at various periods by different observers; and yet there is every evidence to show that traction did not elongate the band, and that if it grew at all, between 1829 and 1874, it was not more than a quarter of an inch. Prof Warren made the measurement at the top of the band in 1829 *two inches.* We make it now *two and a quarter.* There is a difficulty in exactly defining the points at the top of the band from which the measurements should be taken. Eng on his side presents a thick welt of skin at the sterno-xiphoid angle (see Fig.); and on Chang's there is little if anything to mark the point; but placed face to face there is a well defined angle on what is usually the anterior side of the band, where it leaves the thorax, and especially marked on the side belonging to Eng. The measurement here is $2\frac{1}{4}$ inches. If we carry up a vertical line on either side, we shall get the points required upon the top of the band, as here marked out. I K J, represents the curve of the top of the band, viewed laterally. E F, is the anterior measure where the points are well defined. A B, is our line of measurement; C D, we presume to be that of Bolton. G E, and H, F, represent the lines of thoracic curve from above downward, that of Chang being the most convex.

Sir James Y. Simpson, in 1869, gave the top measurement of the band as $4\frac{1}{2}$ inches, which he must have obtained by following the curve, as the direct distance from sternum to sternum does not attain this measure, until we reach a point $3\frac{7}{8}$ inches above the centre of the band. As he also makes the vertical measure $3\frac{1}{2}$, and circumference but $7\frac{1}{2}$, thus allowing for a thickness of only one-quarter of an inch, we must infer that his measurements were very imperfectly made. A vertical section of the band, represents an irregular oval, with its large extremity upward and obliquely forward, and with the greater convexity on the anterior side. The diameter from above downward as taken from the cast, is the same as that given by Bolton, *i. e.*, $3\frac{1}{4}$ inches. The transverse is 2 inches, and circumference $8\frac{5}{8}$. A horizontal section of the thoraces at the point of union, resembles the figure of two playing-card hearts, one larger than the other, with their apices elongated and close together, and contiguous sides flattened to a straight line, so as to bring their bases much more nearly in a side by side position.

Mr. Mayo,[1] Professor of Anatomy, King's College, London, (1831) stated, as the result of his investigations, that, "when either of the brothers coughed, the bond of union swelled in its whole length, proving that they had but one peritoneal cavity." See deductions of Vrolik, and Simpson, to be hereafter referred to.

A French observer,[2] (1836) over the initials E. L., says: "You can penetrate with a finger by the umbilicus into the abdomen."

M. Dubois[3] (d'Amiens) made a very voluminous and chiefly psychological report to the Academie Royale de Medecine, in March, 1836. He formed an opinion that the abdominal cavities did not communicate.

M. Le Sauvage, (1837) previously quoted, was of the same opinion. He says, "I have positively established by all the facts of monstrosity by inclusion (in which the inclosed fœtus is always placed without the peritoneum) that this membrane does not cover the interior of the abdomen until after the arrival of the intestines; the reasons which have led to establish the isolation of the intestines, should have the same value as to the peritoneal membrane." On these grounds, he fully believed in the feasibility of separating the twins, and says: "The most difficult point, and one which requires the most attention, is the division of the complex umbilicus; it being there only, that we might fear to open one or other abdominal cavity. To avoid this grave inconvenience, I think we might separately divide the superior portion of the band, wait the cicatrization of the surfaces, and then include the remainder in a moderately tight ligature, with a view to produce at first, inflammation with gelatino-albuminous exudation, of the portions of peritoneal membrane which might be included in the ligature; then their healing, and afterward the obliteration of the opening of one of the cavities, before the section was finally produced by the ligature."[1]

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[1] British and Foreign Med. Rev., 1841, vol. xii., p. 378.

[2] Journ. Heb. des progress des Sciences Med., 1836, vol. i., p. 30.

[3] Memoirs de l'Academie Royale de Med., vol. v., p. 577.

Prof. W. Vrolik, of Amsterdam, (1841) in his work upon Double Monsters, takes up the subject of the Siamese twins, and expresses the opinion that they were most probably connected by some of the abdominal organs. He brings in illustration the figure of a closely analogous double fœtus (so far as outward conformation is concerned), and shows that in it *the two diaphragms met in the bond of union*, and were connected by a kind of third central tendon at the point of the united ensiform cartilages. *The peritoneums were separated;* but from each of them there was sent down near the middle of the bond of union, a prolongation, forming a kind of coronary ligament to a considerable portion of liver, which passed across the bond, and *connected the main masses of the livers to each fœtus.* All the other organs were completely separate.

Sir James Y. Simpson,[2] of Edinburgh, (1869) examined the twins with much care, upon the occasion of their last visit abroad. He attempted to illuminate the band by means of a powerful light placed behind it, but it proved to be too opaque. He tested their vascular connection by giving a dose of iodide of potassium to Eng, and then, after sufficient time, examining the urine of each by the starch test for iodine. This gave the characteristic colour with that of Eng, but no distinct trace with Chang's; a result which corresponded with the experiment made by Bolton, in 1830, under the effect of asparagus, given at one time to one, and at another to the other.

Prof. Simpson made his examination under great advantages, having had the experience of all those who were his predecessors to direct him in his explorations. He says:—

> "That a large segment of peritoneum enters into the composition of the band on either side, is easily ascertained by touching it below, or laterally, and feeling the full impulse of bowel sent into the band, when the individual on that side coughs." . . . . "That the peritoneal cavity extends entirely through the band is more doubtful." . . . . "When you place your finger on the lower surface of the band, and the cicatrix of the umbilicus there, if the brother on the right coughs, he sends an impelled portion of bowel not only up to, but beyond the point touched; and in the same way, if the brother on the left coughs, the impelled bowel passes somewhat apparently to the right, beyond the site of the central umbilical cicatrix." He refers to the opinion of Bolton and says: "*The herniæ project on either side beyond the middle, though possibly an oblique dissepiment of peritoneum may divide them.*"

It will be seen from the various opinions we have recorded, that the nature of the connecting band was very closely determinable by careful examination, and teratological analogy, during the lifetime of Eng and Chang. Observers differed very materially in their conclusions; for they varied in teratological knowledge, in their mode of physical exploration, and in the position in which they placed the brothers in relation to each other at the time of examination. The effect of the cough test was first discovered in this country, at a time when one brother had a severe cold, and was under medical treatment, after which it became a common mode of investigation. The lower peritoneal pouches were recognized in this way, but the upper were not found, because of their being hidden in large measure beneath the ensiform bridge. The connections between the diaphragms and livers not being recognizable by palpation, their existence was a matter of inference, based upon analogical cases, in which these organs have been found almost always united.

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[1] Op. cit.

[2] Brit. Med. Journ., Feb. 1869, pp. 139 and 232.

Prof. A. B. Cook,[1] of Louisville, in his paper upon "Joined Twins, their Obstetrical and Surgical Management," appears to hold to the belief that the livers were united, and says that a bond of union between livers might be much attenuated by pressure and tension, and speaks of the tolerance by the liver of such treatment. In the cases reported by Zwinger and Böhm, to be hereafter referred to, there does not appear to have been any hepatic connection, but in both the connecting band was much smaller proportionately than in the Siamese twins; and with their exception, very unique in character as compared with the generality of xiphopagous subjects. The length of the connecting band in cases of the type of the Siamese twins, must always be limited, as there can be no elongation beyond the combined measurement of the antiflexed ensiform cartilages. But for this, the length would no doubt be gradually extended under the influence of constant traction. It has been thought by some that Eng and Chang had no true intervening band at birth, but that this was gradually developed by tension. This must be an error, if the position in birth has been correctly given, and their story of torsion in the plays of childhood is well founded. The fact that the ensiform cartilages are united end to end, would appear to indicate that a short, but regularly developed band existed at birth; and besides, the unavoidable tension of one fœtal ellipse upon the other in utero would produce a band, where the union was as circumscribed as in the case in question, or its analogues reported by Zwinger and Böhm.

Whether the peritoneal pouches became gradually elongated or not, we cannot say, as they were independent of any external change; but the different testimonies of Bolton, in 1830, and Simpson, in 1869, would appear to indicate a prolongation of this kind beyond the central line of the band, which seems to have been their limit at the time of Bolton's examination. The attenuated character of the portal isthmus was no doubt, in some measure, due to the constant pulling of one liver upon the other, from gravity, position, and the respiratory movements; although from the small size of the whole connection between the brothers, it must have always been quite an insignificant portal link, as compared with that found in ninety-nine hundredths of the omphalopagi.

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[1] Richmond and Louisville Journal, Jan. 1869, p. 65.

Of omphalopagous twins, the Siamese appear to have very far outlived all their duplex analogues. The Hindoo sisters[1] described by Dr. Andrew Berry, lived to be nearly seven years old, and we have not been able to find an example of an intermediate age. In the Hindoo twins the union was a very extensive one, the girls standing directly face to face, with the tops of their sternums but 6½ inches distant from each other, and pubes 8½ inches. They were not examined after death, but as one was for some time nourished in infancy through food taken by the other, it is more than probable that their stomachs, and, judging from analogy, many of the viscera communicated, or were of double form, as the heart, liver, etc. They were well developed and active, but were obliged to walk sidewise, and to sleep facing, as they had no power to assume an oblique position. As appears in all duplex twins, one was much more robust than the other; but in this case the death of the stronger preceded that of the weaker, instead of the reverse, which appears to be almost universal in diplogenous cases.

Operations upon Xiphopagous Twins.—The only instance of separation which resulted with entire success to both infants, is that which has been handed down from one writer to another, as the "König case;" and occasionally as the "Zwingler case," according to the volume of the Ephemerides originally consulted; Dr. Emanuel König having reported it in brief with a plate, in 1690, Dec. II. An. viii. page 305; and Dr. Theodore Zwinger (*Zwingerus*) much more minutely, in 1691, Dec. II. An. ix. page 291. The fact is that neither of these physicians delivered the mother, or operated upon the children, a midwife having attended to the first, and Dr. Fatio, the second, who also furnished to Dr. Zwinger the statement given under his name. It has also been said in ignorance, that this operation was not well authenticated; when the fact is, that all the details of the case, and the names of the parties engaged, with their positions, etc., are carefully recorded, showing that the witnesses were numerous and reliable. To avoid confusion of titles, we will speak of the case as that of

The United Swiss Sisters, reported by König, and Zwinger, and successfully separated by Dr. Fatio of Basle, in 1689.—We do not propose to translate the original account of Dr. Fatio, with the high-sounding titles he has given to the physicians and surgeons present at the first operation, and distinguished citizens in addition at the second, except to a very limited degree, preferring to condense and simplify the language so as to give a plain statement of the case as follows:—

"The most illustrious, etc., Dr. Emanuel König, gives an account in the Ephemerides, An. viii. 1690, of the wonderful birth of twin girls, born joined together; but since *he was not present at the consultation*, in which the mode of separation was discussed, he has been pleased to give me [Dr. Zwinger] an account written by the operator himself, Dr. Fatio, as follows:"—

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[1] Trans. Med. Chirurg. Soc. Edinburgh, 1821, vol. 2, p. 35.

Clementia M., wife of Martin D., aged 42, mother of three children born singly, gave birth to twins joined at the umbilicus, at Huttingen,[1] in the diocese of Basil (Basle), on November 14th, 1689, after a labour of not more than two hours. Their father had them baptized Elizabeth and Catharine, and on the next day took them "to the house of Dr. Samuel Braun, a surgeon of no small reputation, and asked of him professional aid." Dr. Braun called Dr. Fatio in consultation, and they, on account of the peculiarity and importance of the case, obtained the additional opinions of Drs. Nicholas Eglinger, Theodore Zwinger, Francis Plater, and Frederick Bauhin.

The connecting band is stated to have been formed by a coalition of the xiphoid cartilages, and umbilical vessels, surrounded by areolar tissue, and covered with skin, with a very thick umbilical cord attached to its lower surface. It measured an inch and a half in length, one inch in thickness, and five inches in circumference, which would give a vertical diameter of about two inches. The double funis had been cut and tied by the midwife, at a length of about eight inches, which was found of advantage in the method of operation adopted by the consultation. This was to separate the cord up to its division in the band, tie the vessels to prevent hemorrhage, ligate the band below the cartilaginous link, and when the ligature cut its way out, sever the cartilages by incision.

The description of Dr. Fatio in the original Latin, although very minute, is rendered obscure by the use of newly devised terms, and anatomical expressions of doubtful meaning, so that we are obliged to recur to the intention to decipher the steps of the operation. It would appear from what he states, that when the children cried the band above the umbilical junction "*appeared thick and swollen,*" and that between this and the united cartilages was an almost imperceptible "*isthmus.*" The first of these would lead us to believe that there might have been hernial protrusions into the band from either side toward the umbilical ring; but the examination of the context does not throw any light upon the meaning of the term "isthmus," which is used in two other places, in a way to indicate that it did not apply to a connection of any note, and did not represent a union by a band of homogeneous tissue as in a hepatic isthmus. In the sections of the band given in König's plate (An. viii.), nothing is represented but the cartilages, vessels, areolar tissue, and skin.

After the cords were separated and tied, Dr. Fatio perforated the band with needles, and ligated all below the ensiform bridge, using a second ligature of six wires, thrice carried around, to be tied tighter and tighter, until all the included parts were divided. The ligature having fallen off in nine days, the ensiform connection was severed by a bistoury on November 23d, 1689, in the presence of several physicians, surgeons, and distinguished citizens of the town of "Basil." The parts healed in ten days, and six months afterwards the twins and mother were reported as in good health.

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[1] Probably the present Hattingen, 4 miles north of Basle.

The report of this case by König, having been issued with a plate, appears to have attracted the attention of observers, who from a want of an illustration, have failed to notice the much better one in the succeeding number of the Ephemerides, even such close investigators as St. Hilaire having failed to discover it. We have. therefore, been all the more particular in our own reference to it, and also for the reason that the statement of König is very unsatisfactory, and his measurements entirely in error. It is impossible to determine whether any peritoneum was involved in the ligation or not, as the surfaces revealed were not exposed to view for nine days, and did not show at this date the minute anatomy of the tissues cut through. It is quite possible that peritoneum may have been gradually closed by adhesive inflammation, and divided before the ligature, unless the separation of the cord in the first step of the operation effectually divided from each other the herniæ which appeared to protrude towards the centre from either side under the force of crying.

Dr. Böhm of Gunzenhausen's case of United Twins separated by Incision.[1]—The reporter of this case, was both obstetrician and operator, and it has been said also the father of the twins. The mother was a healthy woman, 25 years old, and had previously been delivered of two living girls at single births. The united ones were delivered by the feet without any special difficulty, as they were small, and their mother's pelvis of large size, on December 25th, 1860. The children, who were a little premature, were united sternum to sternum, but otherwise well formed. The description of the connecting band shows it to have been about the size of that in the Swiss twins, and measured five and a half centimetres vertically, or about two inches. It felt soft, except at the top, where the ensiform cartilages united.

Dr. Böhm performed an immediate operation. He separated the umbilical cord up to its entrance, and tied each half by itself; then made a vertical incision into the band and carefully keeping to the median line, cutting into it very cautiously, reached and divided the cartilages, and then the remainder on the rear side. No vessels were tied, and the incised surfaces were drawn together by three button sutures, lint applied, and then a binder. The children were very much prostrated by the operation, but a resort to a warm bath soon restored them, so that they were able to nurse. The sutures were removed on the third day, and the parts healed mainly by the first intention. One of the children was feeble from the first, and died in three and a half days. The other was nearly five years old when the case was published, healthy, but small of her age. The cicatrix forms folds which radiate from a much wrinkled navel. In the median line is a parting of the linea alba, which, when the report was made, measured nine centimetres long, and three and a half wide. The distance from the lower end of the cicatrix to the pubes, was 4$\frac{5}{8}$ inches. When the abdominal muscles contract, the contents of the abdomen are protruded between the recti muscles, in the form of an oval eminence. This does not interfere with the proper functions of the abdominal viscera.

[1] Virchow's Archives, 1866, page 152.

The want of the same degree of success that was achieved in the previous case, appears to have been due to the fact that the birth was somewhat premature, the infants small and feeble, and the operation immediately by incision, instead of slowly by ligation, and only a small part by the knife. Had these children been operated upon at a later period, it is probable that the result would have been more favourable. As it was, both nearly succumbed from the shock of the operation, and the one that died eventually, never seemed to have reacted properly after its performance. The only advantage of an immediate operation is, that the umbilical cord can be then more readily separated to its bifurcation; but this step might be attained, and the division established by a partial operation, leaving the more severe portion until an age when it might be more safely performed.

The Armenian Twins.[1]—"Under the Roman reign (A. D. 945) two male children were brought from Armenia to Constantinople, well formed in all their extremities, who were united by their abdomens. After they had been for some time an object of curiosity, they were removed under order of government, as it was feared that this accident of nature was a presage of evil. They returned at the commencement of the reign of Constantine VII., and one of them dying, the surgeons undertook to preserve the other by separating him from the corpse. All their skill failed; the second died in three days after the operation."

This case having been several times referred to in teratological monographs, we have made a full translation of the original, such as it is. It is probable that they died at an early age.

General Remarks.—Fœrster has tabulated 114 examples of omphalopagous twins, upon but one of which was there any operation of separation performed; and from the numbers of this type we have recently met with in our researches, it would be no difficult matter to largely increase this list. In the great majority of cases there is no true *band* of connection, but simply a blending of the thoracic and abdominal walls, bringing the fœtuses closely face to face, as in the Hindoo Twins already referred to. In these cases, the viscus which is almost universally duplex, is the liver; and this may be found when the abdominal cavities, and all the remaining viscera are separate. In the Zyphodidymi, of the *narrow-band-type*, we must be prepared to expect that an operation may lay open the peritoneal cavity, and cut through a hepatic connection, most probably containing some true liver tissue. This being the case, ligation by slow degrees is much to be preferred to the knife, as adhesion may be thus effected before the band is finally cut through.

The cases upon record show that those which are born alive are generally small, usually feeble, and sometimes premature, so that they are not in a condition to recommend an immediate operation. Had Eng and Chang been separated soon after birth, they would in all probability have perished, but might have been disconnected by slow ligation, when sufficiently grown to have borne the operation. If their social position had been the reverse, and their birth taken place in an enlightened country, they would no doubt have been separated in infancy; but not having an opportunity until old enough to think for themselves, they chose to remain as nature made them; evincing their opposition to the proposal of disconnection, at one time by shedding tears; another by anger; and always by dissent; so that it was never, except in theory, a question for surgical opinion.

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[1] L'Histoire du Bas Empire, per La Beau. 1776, Liv. 74, vol. xvi., p. 28.

Xiphopagous twins are more frequently of the female sex, and are born with much less difficulty than from their nature might be supposed. Being, as already remarked, usually of small size, they are not infrequently delivered without any more than the ordinary manual assistance, after a short labour, and particularly so where the pelvis is large, and the feet present together; but both podalic and cephalic presentations may be regarded as favourable. Injurious interference will often lead to the death of the children when unassisted nature may be able in time to deliver them alive. The management of the labour will depend very much upon the relative dimensions of the twins and pelvis; the position of the former, and the stage at which assistance is obtained. The most common causes of death are pressure upon the large funis; and the means resorted to to deliver in cases of impaction in the pelvis, such as section, evisceration, etc. It is also probable that many do not respire after birth, because of imperfect organization of the nerves and circulatory organs; but judging from the case of the Hindoo Twins, who belonged to one of the most common omphalopagous varieties, it would appear that many might live, if not destroyed in the pelvic canal by manual or instrumental violence. The desirability of such a result is a question entirely separate from its possibility. We feel called upon often to attempt to save or prolong life when, in our judgment, its continuance can hardly be thought desirable. As we cannot know exactly the character of union, or the degree of perfection in the children united, until they shall have been delivered, it is best in all cases to exercise every degree of precaution, and particularly so, as it may prove possible to separate them after birth, as in the Swiss Sisters.

Our recollection of the Siamese Twins is based upon their appearance as presented to us when they were about twenty-five years of age, at which time they were of the colour and appearance of some of the Chinese now in this country. As they grew older they became darker in skin, especially of their faces; and the band had more of a brownish hue. Their heads were not of typical shape as indicative of race, being large, high, and somewhat square, Eng's measuring in circumference 23$\frac{3}{4}$ inches, and Chang's 22$\frac{1}{2}$ inches. Although exhibited in our chief cities, and long resident in the United States, they never appear to have attracted the scientific interest here that they did in Europe, and scarcely any reference is made to them in our medical journals from 1829 until after their death; so that we have been obliged to quote foreign articles almost entirely when considering their anatomical connection, and the question of separation.

We have been repeatedly asked the question, "Could they have been safely disunited?" and upon this appears to centre with the community, the whole interest in their case—it being long ago established that they were mentally, morally, and physically quite unlike—there still remained to be settled the question as to the possibility of making them independent beings by a surgical operation, so that they should be in all respects separate and distinct. We have also been asked if the autopsy showed the band to have been different from what it was expected should be found.

To the first question we reply that the opinion has been almost universal, that it was quite possible to separate them by slow degrees with safety, but that the operation must necessarily be attended with the usual risks of those practised upon the abdominal parietes involving the peritoneum. This opinion has not been materially altered by the revelations of the post-mortem examination. An immediate operation by the knife, would probably have been of equal gravity with one of ovariotomy; but that proposed by Le Sauvage promised much more favourably

The second query can only be answered by reference to the combined views of numerous investigators. No one observer formed a correct opinion as to the entire anatomy of the band; but collectively, Bolton, Simpson, Cook, Vrolik, and Warren, may be said either to have found, or established by analogy, the existence of almost every important feature shown by the autopsy, viz., the lower peritoneal pouches of, first, Chang at the bottom of the band, coming into it from the left; and, second, Eng just above, and overlapping it from the right; the hepatic connection; the ensiform connection and joint; the interlacing of the diaphragms; and the independence of the two peritoneal cavities, and of the intestines. This covers all the features revealed, except the infra-xyphoid peritoneal pouch of Chang, and the slight vascular intercommunication of the livers shown by the coloured injection, passed from Chang into Eng.

It must be admitted that the character of the band was sufficiently well established during life to enable a surgeon to decide intelligently as to the risks of an operation of severance. All of the Surgeons consulted in Europe in 1869, held that the twins were not at an age to admit of the performance of the operation with any but the faintest hope of a favourable result. They were then 57 years old; Chang was quite intemperate, and soon afterwards became hemiplegic; and both probably had diseased arteries, as they were found atheromatous, and had undergone calcareous degeneration at the time of their death, five years later. But this was not the calculation of risk given when Eng and Chang were young and active.